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The Early Prevention of Diabetic Foot Ulcers

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The Early Prevention of Diabetic Foot Ulcers

by

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Abstract

Frequent and proper foot exams and foot care are fundamental in decreasing the incidence and morbidity of diabetic foot ulcers, yet many patients are still not screened at appointments or educated on the importance of foot exams. This research planned to address the lack of foot care education and foot assessments amongst patients with Type 2 diabetes. Past research done on this focused on providing education to diabetic patients either at home or in a setting where patients can come and receive the education. To our knowledge, no research has been done on the use of video teaching to provide diabetic foot care education. This project used a survey approach to gather quantitative data about the practices of patients in the clinic. The target population for this study was diabetic patients with Type 2 diabetes who are above age 18. The project was implemented over 3 weeks. Patients who agreed to participate were provided with a video education on diabetic foot care and ulcer prevention. Twenty-four participants completed the pre-survey, and 20 participants completed the post-survey. Post-intervention patients' foot ulcer knowledge improved by 59.2% and foot care knowledge improved by 53.47%. Post-intervention 75% of participants stated they would implement foot assessments daily an increase of 52.78%. This study concluded that video teaching can be used to improve diabetic patient knowledge and practice of foot care and foot assessments. The potential benefits of video teaching combined with the low cost make video teaching a great tool for improving patient knowledge and self-care behavior.

Keywords: Type 2 diabetes, foot care, foot assessments, video teaching

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Problem Recognition

Globally 463 million adults are currently living with diabetes, and the incidence is predicted to rise to 700 million by 2045 (Jones et al., 2021). More than 30 million people in the United States are affected by diabetes (Del Core et al., 2018). In the United States alone, diabetes was the seventh leading cause of death in 2006 (Bonner et al., 2016). One of the most common problems with the care of a diabetic patient is the incidence of diabetic foot ulcers which has an annual incidence of 2.2% (Del Core et al., 2018). Diabetic foot ulcers often lead to serious complications such as infection, amputation, and death (Del Core et al., 2018). Among those diagnosed with diabetes, 15-25% will likely develop a foot ulcer in their lifetime (Jones et al., 2021). Infections occur in up to 58% of patients presenting with a new foot ulcer (Del Core et al., 2018). An estimated 40% of ulcers will reoccur within a year after healing, and the incidence increases to almost 60% within 3 years (Jones et al., 2021). A study found that up to 5% of diabetic patients will require a major amputation in 1 year with a 5-year mortality rate as high as 45% for neuropathic ulcers and 55% for ischemic ulcers (Del Core et al., 2018). An estimated $9-$13 billion per year is spent on treatment in the United States (Jones et al., 2021).

Diabetic foot ulceration is the most common and debilitating complication of diabetes with a lifetime incidence of up to 25% (Boulton et al., 2008). A diabetic foot ulcer is a major health complication of diabetes due to its impact on physical and psychosocial functioning. Patients with diabetes are at an increased risk of diabetic foot ulcer recurrence, amputation, and mortality. The treatment for diabetic ulcers often involves prolonged hospitalizations with one-third of the direct cost for treatment of

diabetes linked to diabetic foot ulcers. Delay in referral of serious foot problems is cited as one of the main reasons for patient morbidity and mortality (Coffey et al., 2019).

Despite the national and international guidelines on the management of diabetic foot care emphasizing education and self-care, many patients are without proper care and lack the education they need to prevent diabetic foot ulcers (Wuri Kartika et al., 2021). Vital management of diabetes includes lifelong self-care practices, but not all diabetic patients can follow self-care activities as recommended. Older adults in the home encounter many difficulties in self-care activity due to the aging process such as cognitive dysfunction, functional impairment, polypharmacy, vision and hearing impairment, and depression (Wuri Kartika et al., 2021). With the highest prevalence incidence in older patients, daily activities such as foot inspection and hygiene that help patients identify early signs of complications are often lacking in the home (Wuri Kartika et al., 2021).

In Wake County, North Carolina 9% of adults aged 20 and over are diagnosed with diabetes (University of Wisconsin Population Health Institute, 2022). This affected population requires quality diabetic management and education; in this DNP project specifically, management and education related to diabetic foot care. Among Medicare beneficiaries, 8% of those with diabetes have a foot ulcer (Edmonds et al., 2021).

Problem Statement

Frequent and proper foot exams and foot care are fundamental in decreasing the incidence and morbidity of diabetic foot ulcers, yet many patients are still not screened at appointments or educated on the importance of foot exams. Inadequate foot care is associated with higher rates of diabetic foot ulcers which can lead to lower extremity

amputation, decline in functional status, infection, and death (Hicks et al., 2016). The cost of hospital care related to diabetic foot ulcers has increased significantly over the last 5 years and inpatient diabetes care accounts for 50% of the national diabetes burden (Hicks et al., 2016). Thirty-three percent of care related to diabetes is linked to the treatment of foot ulcers with the majority of the cost inpatient hospital admissions (Hicks et al., 2016). The American Diabetes Association recommends at least an annual comprehensive foot exam for all patients with diabetes and screening every 3-6 months for high-risk patients. According to data from the National Health and Nutrition Examination Surveys (2005–2010), only 28.6% of adults with diagnosed diabetes reported they had not had a health professional check their feet for sores or irritation in the past year despite the recommendation of the American Diabetes Association for yearly examinations (Hicks & Selvin, 2019). The Centers for Disease Control and Prevention data showed that adults diagnosed with diabetes who received a foot exam in the last year were only 67.5% in 2010 (Hicks & Selvin, 2019). A foot care intervention focused on education can greatly benefit diabetic patients and decrease the risk of developing diabetic foot ulcers.

Literature Review

A review of literature was performed using various databases such as PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), MedlinePlus, EBSCOhost, and Nursing and Allied Health databases. The articles were retrieved using various keywords including diabetic foot ulcer, diabetic foot care, diabetic neuropathy, diabetic foot ulcer management, and diabetic foot ulcer prevention. The search strategies included articles that were published in the last 10 years. Articles that were not in

English, lacked full text, were not peer reviewed, and did not mention diabetic foot ulcers were excluded. The search resulted in 123 articles after all exclusions. References from the articles included were reviewed and used to identify any missed studies.

Proper Foot Self-Care in Diabetics

Proper foot self-care can reduce the risk of injury, infection, and amputation in someone at risk of diabetic foot ulcer. Daily foot care should include foot and shoe gear checks, proper daily foot hygiene, not walking barefoot, wearing appropriate footgear, trimming toenails, avoiding anything abrasive on the foot, early professional care for open wounds and lesions on the foot, and routine foot exams by a professional trained to identify foot complications (Armstrong & Lavery, 1998). Lack of knowledge has been identified as the contributing factor for why people with Type 2 diabetes do not practice foot self-care. Providing additional education can lead to improved knowledge, self-care behaviors, and reduction of foot complications. Diabetes self-management education (DSME) has been shown to be the foundation for the improvement of disease-related health outcomes (Bonner et al., 2016). Patients not offered DSME are at 4 times greater risk of developing Type 2 diabetes-related complications when compared to those who have had some form of DSME (Bonner et al., 2016). Early interventions and education have the ability to lower rates of lower extremity amputation by up to 85% (Bonner et al., 2016). Diabetic foot ulcer is preventable in adults with diabetes if proper care is taken. Strategies for prevention should include patient and staff education, multi-disciplinary treatment, and close risk monitoring (Schaper et al., 2022).

Risk Factors for Developing A Diabetic Foot Ulcer

Risk factors for diabetic ulcers are correlated with poor practice and knowledge deficits; Highly educated patients have higher foot care knowledge and a lower incidence of diabetic foot ulcers (Pourkazemi et al., 2020). A patient's age can affect diabetic foot care knowledge with older patients generally having less foot care knowledge. Diabetic foot complications are higher in men and people with Type 2 diabetes. The prevalence of peripheral vascular disease in people with diabetes is 20% in patients under 40 and 29% in patients over 50 (Elkashif et al., 2021). Sensory neuropathy is the main and most important causative factor, which is usually deep (>50%) before experiencing a loss of protective sensation resulting in susceptibility to physical and thermal trauma and increased risk of foot ulcers (Wuri Kartika et al., 2021). Risk factors for diabetic foot ulcers include male sex, diabetes of more than 10 years, peripheral neuropathy, abnormal foot structure (bone alterations, calluses, nails thickening), peripheral arterial disease, smoking, history of ulcers or amputation, and inadequate glycemic control (Wuri Kartika et al., 2021).

In the study by Wuri Kartika et al. (2021), a home-based intervention program was done which included diabetes self-management education (DSME) and wound care by a home health nurse. The intervention was carried out by the community health nurses for 8 weeks with home visits to a 69-year-old man who already experienced a diabetic foot ulcer twice in the last 3 years and already suffered amputation. At the end of the study, the patient reported significant improvement in his diabetes self-management practices, blood glucose level, and wound healing. The study result showed significant changes in the patient's diabetes self-management practices, blood glucose level, and

wound healing. The study is limited in the number of participants that were used with this study. The study only had one participant, so it did not provide much comparison of results. A key finding and strength of this study was that it showed the role of family involvement in treating and preventing DFU. The study concluded that a home-based intervention program is the best approach to engaging families and overcoming the barriers to self-care management and reoccurring diabetic foot ulcers. The family can play a role in monitoring foot ulcers, especially in elderly patients.

A study carried out by Elkashif et al. (2021), examined the effect of establishing a protocol for foot self-care of diabetic patients based on their needs, concerns, and medication use. A quasi-experimental (pre-test and post-test) design was used in outpatient clinics at Benha University Hospital, Egypt. The study included 100 adult patients diagnosed with both Type 1 and 2 diabetes for at least 6 months. The interventional group received diabetes education at intervals. The research used the Nottingham Assessment of Functional Foot Care, used to obtain well-rounded responses regarding foot self-care practices. It is used to assess the compliance of diabetic foot patients with foot care behavior recommended by healthcare providers. The limitation noted in the study was the use of a nonprobability convenience sample to select the study sample which created selection bias which may not be representative of all diabetic foot patients. At the end of the study, there was marked improvement in patients' foot care knowledge and self-care practice post implementation of the protocol in comparison to pre-intervention. The study concluded that establishing a protocol for diabetic foot care fosters self-care practice and knowledge. The results of the study may be used to

encourage decision-makers to formulate efficient policies and standards used to overcome diabetic foot problems.

In the study by Pourkazemi et al. (2020), they examined the knowledge and practice of patients with diabetes regarding the prevention and care of diabetic foot ulcers. This was an analytical, cross-sectional study conducted in Guilan Province which is north of Iran on 375 patients registered in the medical records as having Type 2 diabetes mellitus. The study examined the demographic characteristics, knowledge, and practice of participants in relation to diabetic foot care in the form of a questionnaire during face-to-face interviews conducted by the researcher. Most participants had poor knowledge and poor performance which showed that there is a significant and direct correlation between knowledge and practice. Other factors such as knowledge level, place of residence, marital status, and history of admission due to diabetic foot were predictors of practice score. The study concluded that a targeted educational program is needed to promote knowledge of patients with diabetes. The strength of the study was that it was the first study done in Guilan Province on this topic so it will help increase awareness in the country. The study's limitations were its cross-sectional design which limited the ability to determine the direction of relationships and causal relationships. The study was hospital-based which limits its ability to provide a true picture of knowledge and practice in the community.

Salameh et al. (2020) conducted a study to identify certain sociodemographic, lifestyle, self-care, and foot examination factors that predict the development of diabetic foot ulcers. A case-control study was performed in Palestine in 2019. The control group consisted of diabetic patients without foot ulceration. The case group included diabetic

patients who had foot ulcers with a size not less than 0.5 cm2. The study showed that risk factors for developing diabetic foot ulcers included smoking, sensory loss to vibration, sensory loss to monofilament, loss of pedal pulse, presence of calluses, nephropathy, retinopathy, and neuropathy. Illiteracy and low income were significantly associated with the development of diabetic foot ulcers as well as poor self-care. The study was limited in that the role of family support and diabetes distress was not considered as a predictor for foot self-care behavior and its association with foot ulcer development. The lack of equipment and specialists available to complete a vascular screening including palpation of distal pulses was not undertaken with study participants. Only a few studies have been done in Palestine to study diabetic foot ulcers. This study showed the independent risk factors for the development of diabetic foot ulcers and how illiteracy and lower income were significantly associated with DFU development. The findings in this study will help physicians and nurses to design appropriate programs such as integrating audio-visual teaching strategies in the prevention of DFU teaching.

A study by Ahmad et al. (2018) evaluated the effectiveness of a health education program based on the self-efficacy theory on foot self-care behavior for older adults with diabetes. A randomized controlled trial was conducted for 12 weeks among older adults with diabetes in an elderly care facility in Peninsular Malaysia. The intervention group received a health education program on foot self-care behavior while the control group received standard care. Participants were assessed at baseline, week-4, and week-12 follow-ups. The primary outcome was foot self-care behavior while secondary outcomes included foot care self-efficacy, foot care outcome expectation, knowledge of foot care, and quality of life. The study concluded that foot self-care behavior, foot care self-

efficacy, foot care outcome expectation, and knowledge of foot care improved in the intervention group compared to the control group ($p < 0.05$). The strength of the study is the finding that the majority of older adults with diabetes reported that they were not receiving health education on diabetes, hence the need for further encouragement to elderly patients in care facilities to receive more diabetes care education and proper foot care training. The study was limited in that the data collection process may have been affected by reporting bias due to participants being unable to answer questions independently. Some participants in the control group may have obtained information from other sources.

Oni (2020) looked at the gaps between the American Diabetes Association's clinical recommendations on preventive foot self-care and perceptions of and actions taken by patients with diabetes and diabetic foot ulcers. A systematic review was performed using PubMed, the Cumulative Index of Nursing and Allied Health Literature, Cochrane Online Library, Psychological Information Database, and Google Scholar for qualitative research literature published in English from January 1, 2001, to October 21, 2016, with the terms diabetes mellitus, diabetic foot ulcers, foot care, experiences, and perception to examine the experiences of patients with diabetes regarding foot self-care practices. Common themes identified in the study were the high clinical and lifestyle burden of diabetic foot ulcers, poor foot self-care knowledge, perception barriers and resistance, lack of adoption of self-management practices, and discordance between patient and provider impressions and expectations. The study concluded that the health belief model could be used to address some of the barriers to care for diabetic foot ulcers. This research was limited because most studies were conducted in different countries

with diverse cultures so the results could be skewed. Different essential data such as patient comorbidities or rate of re-ulceration were not reported in all studies. The strength of this study is that it addressed patient's beliefs and perceptions about foot self-care practices whereas past studies only focused on improving knowledge without considering beliefs.

Remington et al. (2016) examined readmission rates following inpatient care for a diabetic foot ulcer and identified modifiable factors associated with all-cause 30-day readmissions to the inpatient or emergency department setting. The study looked at patient discharge records containing diabetes mellitus and distal foot ulcers in the State Inpatient and Emergency Department databases from the Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project in Florida and New York, 2011–2012. The cohort included 25,911 discharges, with a mean age of 63 and an average of 3.8 comorbidities. The overall rate of return to care was 30%, with 21% of subjects undergoing a toe or midfoot amputation during their stay. The most common diagnosis codes for readmission were diabetes mellitus (19%) and infection (13%). The study determined that patients with a toe or mid-foot amputation procedure were less likely to be readmitted within 30 days, while the presence of comorbidities, black and Hispanic ethnicities, and Medicare and Medicaid payer status were associated with higher odds of readmission following initial hospitalization. The study was limited due to its selection of discharge records. The ICD-9 code of 707.15 was used for distal foot ulcer patients but other lower extremity and proximal foot ulcers may not have the same causes and risks of readmission.

The International Working Group on the Diabetic Foot (IWGDF) provides evidence-based guidelines on the prevention and management of diabetic foot disease. In 2019, the updated guidelines included systematic reviews of the literature and formulation of recommendations by multidisciplinary experts from all over the world. According to their guidelines, having two or more risk factors such as diabetic peripheral neuropathy and peripheral artery disease increases a person's chance of developing foot ulcers (Schaper et al., 2022). The risk factors that predispose a patient to foot ulcers include peripheral neuropathy, foot deformity, peripheral vascular disease, previous foot ulceration, and previous amputation of the foot or leg (Van Netten et al., 2016). Peripheral artery disease is seen in 50% of patients with diabetic foot ulcers (Hicks & Selvin, 2019). Peripheral artery disease leads to impaired wound healing resulting in lower extremity amputation. Peripheral neuropathy causes decreased sensation. In people with peripheral neuropathy, minor trauma can precipitate ulcer formation of the foot. The estimated prevalence of peripheral neuropathy among adults with diabetes in the US is 28% (Hicks & Selvin, 2019). Patients without any of these risk factors are usually not at risk for ulceration (Bus et al., 2020). Ninety percent of hospital admissions for diabetic foot ulcers are related to peripheral neuropathy. Implementation of regular foot exams in diabetic patients has been shown to reduce the rate of ulcers and is essential in preventing the progression of the disease to infection or lower limb amputation (Hicks & Selvin, 2019). Patients with major risk factors should be educated on amputation risks and referred for dedicated foot care and surveillance (Bus et al., 2020). Given that approximately 50% of adults with diabetes will be affected by peripheral neuropathy in their lifetime, more diligent screening and management of the diabetic population are

important to reduce the complications and healthcare burdens associated with the disease (Hicks & Selvin, 2019). Schaper et al. (2022) have identified five key elements for the prevention of foot ulcers which include: identifying the at-risk foot, inspecting, and examining the at-risk foot regularly, providing education to the patient, family, and health care provider, ensuring routine wearing of appropriate footwear, and treating risk factors for ulceration.

Interventions to Decrease Incidence of Diabetic Foot Ulcers

The American Diabetes Association (2021) released recommendations for foot care for providers to include foot evaluations annually to identify those at risk for ulcers and amputations and those with evidence of sensory loss or prior ulceration should have their feet inspected at every visit. Therapeutic footwear for high-risk patients and general preventative foot self-care education are recommended. The key to preventing ulcer formation is meticulous attention to the foot as well as proper management of minor foot injuries (Pérez-Panero et al., 2019). Daily foot inspection is the cornerstone of proper foot care. To prevent breakdown, the patient should cleanse the foot with soap and water, followed by the application of topical moisturizers to resist breakdown and injury. Patients should avoid hot soaks, heating pads, and harsh topical agents such as hydrogen peroxide, iodine, and astringents (Armstrong & Lavery, 1998). Minor foot injuries such as cuts, scrapes, blisters, and tinea pedis can be treated with gentle cleansing and the application of topical antibiotics to maintain a moist wound environment that can prevent ulcer formation (Armstrong & Lavery, 1998). The role of the physician in preventing foot ulcers is to inspect the patient's shoes for areas of inadequate support or improper fit,

inspect the patient's foot regularly at appointments, and reinforce preventative advice (Bus et al., 2020).

While most of these studies were done in less developed countries, the risk of complication remains the same for low-income patients with limited education and limited access to care in the United States. Structured, organized, and repeated education is important in preventing diabetic foot ulcers. The goal of education is to improve the patient's foot self-care knowledge and self-protective behavior and to enhance their motivation and skills as well as facilitate adherence to that behavior (Dorresteijn et al., 2014). Education should include how to recognize foot ulcers and pre-ulcerative signs and the steps to take when the problem arises (Bus et al., 2020). The education provided should be structured, provided in multiple sessions, with periodical reinforcement using a mixture of different teaching methods. The education should also be culturally appropriate, account for gender differences, and align with the patient's health literacy and personal circumstances (Dorresteijn et al., 2014). The educator should assess whether the person understood the message given and is motivated to act and adhere to the advice. The healthcare profession providing education should also receive education periodically to improve their skills to properly care for these high-risk patients.

Needs Assessment

Target Population

The target population for this study is diabetic patients with Type 2 who are above 18 and have had at least one visit to the outpatient clinic and are willing to participate. The study will exclude critically ill and mentally incompetent patients unable to provide information or understand its requirements. Project inclusion criteria require patients to

be at least 18 years old, have a diagnosis of Type 2 diabetes on their current problem list or medical history, and are English speaking. Patients seen at the clinic are Medicaid, Medicare, and uninsured patients. These patients are at higher risk of developing diabetic foot ulcers due to a lack of education and resources. With the rapidly increasing prevalence of diabetes coupled with personal, societal, and economic costs of diabetic foot ulcers, an effective prevention strategy and support are needed to combat this problem (Coffey et al., 2019). Age, socioeconomic status, and race have been identified as risk factors for the development of diabetic foot ulcers (Salameh et al., 2020). Many patients at this identified practice site have at least two or more of the identified risk factors.

PICOT Question

The PICOT format is used to structure a question to help address the intervention and better understand the clinical issue and the proposed solution. The (P) stands for population which refers to the patient/population or problem you wish to solve. The (I) stands for intervention referring to the treatment provided to the subjects enrolled in the study. The (C) stands for comparison and is what you plan to use as a reference group to compare with your treatment intervention. The (O) stands for outcome which represents what result you plan on measuring to examine the effectiveness of your intervention. The (T) stands for time which refers to the duration of the data collection.

In a primary care office, will implementing a video teaching to Type 2 diabetic patients over the next 3 weeks improve patient knowledge of foot care and encourage providers to provide foot screenings?

SWOT Analysis

A Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis is shown in Figure 1.

Figure 1

SWOT Analysis

Problem	Analysis
Strengths	• Private firm • Owner has over 23 years of experience in the business • Employees speak 5 different languages • Diverse employee population
Weaknesses	• No current practice for diabetic foot care education • No educational resource in the facility for foot care • Limited staff • Paper charting
Opportunities	• Enhanced training and education • Faster transition to electronic charting, • Market growth.
Threats	• Low level of education for patients • Language barrier between patient and staff • Limited available resources.

The project site is a privately-owned primary care office. The owner, who is also the primary provider in the office, has over 23 years of experience in the business which makes it easier for him to be able to manage complex illnesses such as diabetes. The employees all come from diverse backgrounds and speak five different languages, which allows them to provide care for a more diverse population and educate the patient in their

own language without an interpreter. The employees are also able to provide culturally appropriate care which improves customer satisfaction and educational adherence. Some organizational weaknesses include no current practice for foot care education, no education resource for foot care in the facility for providers, and limited availability of staffing. The office is currently transitioning to e-charts, so paper charting is still being used. The providers in the practice are not regularly educating patients on foot care practices and how to prevent diabetic foot complications. At this practice, there is no nurse available to educate patients to make it easier for providers so that it is not taking time from their visit to provide this additional education. The fact that they still use paper charting on some of the patients makes it harder for providers to easily assess whether foot care education was given to patients.

Opportunities include enhanced training and education, a faster transition to electronic charting, and market growth. With the addition of foot-care education, the practice can improve the quality of care provided to diabetic patients. Adding an educational intervention can also provide the practice an opportunity to work faster in transitioning to electronic charting. With the push from the government to have all medical practices under e-chart, this could give the practice a boost to transition faster. This foot-care intervention is also an opportunity for the providers to enhance their training and education on diabetic foot care. Today's patients want to be educated and included in their care. By providing foot-care education, patients will feel more empowered and satisfied with their care thereby referring family and friends to the practice which would lead to market growth.

The low level of education of the patients, as well as the language barrier, is a major threat to the project. The office does not have a translation machine so it would be hard to provide education to patients of different languages when the staff is unavailable to help translate. The level of education could also affect the way the patient receives and understands the education given.

Desired Outcomes

Despite the availability of evidence-based guidance, many patients with Type 2 diabetes do not achieve treatment goals. Primary care clinicians face multiple challenges in the complex management of patients with diabetes. They struggle to keep up with changing recommendations, time constraints, and evolving treatment targets within limited time and resources, and express frustrations with resulting compromises in care. Large workloads and resulting time pressures undermine clinicians' abilities to deliver care to their own satisfaction. The desired outcome of this project is to increase diabetic foot care compliance while encouraging a multi-departmental approach to diabetic foot care that will make it easier for physicians and patients to reach desired outcomes. Providing patients with an educational video on diabetic foot care and ulcer prevention prior to them seeing their provider, would provide the patients with the education they need on diabetic foot care and encourage providers to perform foot assessments thereby increasing the office compliance rates on annual assessment while increasing patient knowledge on diabetic ulcer prevention and foot care. This would impact practice by making providers more proactive in preventing and managing diabetic foot ulcers. By facilitating this foot care education, the patients would become active participants in their healthcare, promoting the prevention of foot ulcers. Results may encourage decision-

makers to formulate efficient policies and standards, and establish bases and rules for evidence-based planning to overcome diabetic foot problems and their impacts on patient lives and their cost on the healthcare system (Elkashif et al., 2021).

Team Selection

The team consisted of the practice partner, the project chair, and the project leader. The practice partner is an employee of the facility where the project will be done. The practice partner is a medical doctor with over 20 years of experience in the field and multiple published articles. The practice partner is the private practice director and will support the DNP project leader and staff. The practice partner will help make sure the staff is on board with the project as well as offering insight.

The project chair holds a doctoral degree as a family nurse practitioner. The project chair will provide guidance and support to the project leader. The project chair will help guide the student in choosing the best intervention, implementing the intervention, and making sure that the project leader follows appropriate protocols and procedures.

The project leader was a DNP student with experience as an NP student at the project site. The role of the student is to plan, implement, and evaluate the intervention. The project leader has no conflict of interest with the site or participants.

Sponsors and Stakeholders

The stakeholders of this project would include the patients, practice owner, providers, and students. The practice owner would gain an increase in customer satisfaction with the addition of foot care training and education to his clinic. The other providers in the clinic, as well as the nurse practitioner students, could also benefit from

the project because it improves the care they are providing to their patients, increasing their patient satisfaction while enhancing their knowledge of diabetic foot care practices. For patients, enhancing their knowledge regarding diabetic foot care can avoid risks and help with healing, improving their health and quality of life, while reducing the risks of the physical, social, and emotional impacts associated with the problems related to diabetic foot ulcers.

Scope of Project

This project will expand the need for additional foot self-care education by assessing the patient's knowledge and practice for foot care. With the result of the project, the practice can assess patients' need for foot care education and provide them with the necessary education.

Goals, Process, Outcomes, Objectives, and Mission Statement

Goals

The purpose of this project was to improve the care of diabetic patients at risk for ulcers in a primary care setting. The goal is to implement foot care education among Type 2 diabetic patients at the project site to improve their diabetic foot care knowledge, skills, and compliance with foot self-care.

Process

Quality Improvement (QI) application approval was received by the Gardner-Webb University Hunt School of Nursing QI Committee before the project's implementation. The first step was to create an educational video for patients to include all information related to diabetic foot care and ulcer prevention. An educational PowerPoint was created for providers to introduce the QI project and included all the

current recommendations by the American Diabetes Association for foot care, ulcer prevention, and provider foot assessments. All project documents and education were printed and made available to staff. The office staff was educated on the project purpose, goals, and patient and staff requirements. The office staff provided access to the project information to the patients meeting project inclusion criteria via a script (Appendix A). The patients included in the project survey were educated on the project and consent (Appendix B) was obtained after they accessed the project link (available via QR code). The DNP Project Leader's role was to educate staff on the project's purpose and their role in making sure the patient received a link to an educational video (Appendix C). The DNP project leader also ensured that the providers in the office were offered the educational PowerPoint to help them refresh their knowledge on the project topic. Project participants were required to consent to participate and those that did not want to participate were offered the educational video for their own learning. Participants who consented were provided with an electronic pre-survey and a post-survey after watching the educational video. The intervention was implemented over 3 weeks with the hope of gaining as many participants as possible during this time. An anticipated 45-75 patients would meet the criteria with the minimum participation goal of at least 25 participants. The DNP Project Leader was not employed by the practice site and participated in this project site as a Family Nurse Practitioner student only. To protect the subject's confidentiality no patient identifiers were used such as name, date of birth, address, or medical record number.

Outcomes

The pre-survey and post-survey data were used to evaluate the success or failure of the educational video intervention. The survey questionnaire consisted of five questions. A Likert scale was used for responses, including “not knowledgeable”, “somewhat knowledgeable”, “knowledgeable”, very knowledgeable”, “never”, “daily”, “weekly”, “monthly”, “yearly”, “yes”, and “no”.

The pre-intervention questions were as follows:

1. What is your knowledge level about diabetic foot ulcers?
2. What is your knowledge level of diabetic foot care?
3. How often do you perform foot assessments?
4. How often do you perform foot care?
5. Do you immediately report any skin abnormalities such as blisters, callus, pain, or infection to your doctor?

The post-intervention questions were as follows:

1. What is your knowledge level about diabetic foot ulcers?
2. What is your knowledge level of diabetic foot care?
3. How likely are you to implement foot assessments into your routine?
4. How likely are you to implement diabetic foot care into your routine?
5. Do you immediately report any skin abnormalities such as blisters, callus, pain, or infection to your doctor?

Objectives

The objectives for the program were as follows:

- To provide diabetic foot care education to at least 25 Type 2 diabetic patients for 3 weeks of project implementation.
- To improve diabetic patients' knowledge of foot care by 40% as measured by the foot care questionnaire by the end of the project implementation.
- To increase the number of Type 2 diabetic patients who report planning to engage in self-foot assessments by 40% after receiving the video education.

Mission Statement

Diabetic patients are at an increased risk of developing diabetic foot ulcers due to the disease's nature coupled with a lack of self-foot care routine. Primary care providers are in a unique position to help decrease the incidences of diabetic foot ulcers through risk identification and adequate teaching. This project's mission is to improve the clinic's care of diabetic patients by increasing the number of patients educated about foot care and engaging in foot care to ultimately decrease the rates of ulcer occurrence. The patient and the staff would both benefit from this protocol. The patient would benefit by learning how to properly care for their feet, decreasing their risk of foot ulcers, and amputation, which could drastically decrease their quality of life. The staff would benefit from the knowledge and satisfaction that they receive from helping patients. This would also benefit the clinic by opening the door for other quality improvement projects to be created that could make it easier for patients and staff.

Theoretical Framework

The theory being used to guide this project is Orem's Self-Care Theory (Figure 2). The concepts used for this project include self-care, self-care agency, and therapeutic demand. The use of self-care has been shown to maintain and improve the life and health

of a person. According to this model, self-care is a learned behavior and initiation of activities by an individual necessary for them to maintain their own life. Self-care agency is an individual's ability to be involved in self-care. Self-care agencies are affected by multiple conditioning factors including age, gender, developmental and health state, health care and family system, and environmental and sociocultural factors (O'Shaughnessy, 2014).

Figure 2

Orem's Self-Care Theory

To assess self-care deficit, a pre-survey was used to gather data about the patient's current foot-care practice. With the assistance of office staff, diabetic patients were identified as those scheduled for routine checkup visits. During their office visit, diabetic foot care educational intervention was offered. The educational intervention provided patients with the foot care knowledge that they need to perform foot care behaviors at

home. After the educational intervention, patients complete their scheduled appointments where the provider can perform foot assessments that would thereby increase self-care knowledge.

Lewin's change theory is a second theory used to guide this intervention. The theory is comprised of three phases: unfreezing, change, and refreezing (Zaccagnini & Pechacek, 2021). According to Lewin's theory, for change to happen, the individual and organization must first realize that change is needed; this is unfreezing. Once unfreezing occurs, change can begin. During this step, people will begin to learn new behaviors, new processes, strategies, and a different way of thinking. This is usually the hardest step because people struggle with their new reality. The last step is the refreezing step. This step is to ensure that the recent changes that have been put into place become the new norm and that staff do not revert to their old ways of thinking or doing prior to the change's implementation.

The first part of the project was to convince the stakeholders that the current process was not working, and change was needed. Research and evidence gathered on the topic were provided to show the need for educational intervention for diabetic patients at the practice. The project leader also provided research gathered from patient charts that showed that diabetic foot education is not being consistently provided. The goals of the unfreezing stage would be to create awareness of how the current practice and procedure could be improved to better support the patient's needs. Once unfreezing was completed, change began with the implementation of the new process. With the addition of educational resources, practice employees were provided with the knowledge that they would need to feel more comfortable to be able to accomplish their goals. The project

leader's role was to support and guide the staff and constantly remind them of the benefits of providing additional education to patients. The project implementation brought the current need for diabetic foot care education to the forefront with hopes of creating more awareness on the topic.

Work Planning

The project's success depended on the completion of various tasks within different time limits. The planning phase determined the financial resources and manpower required to complete this project. The GANTT chart in Figure 3 details the tasks that needed to be completed and the timeline assigned for its completion. This tool was effective in making sure that the project stayed on task, thereby improving efficiency. Tasks that were delayed were assessed for dependent issues affecting their completion. The work breakdown table in Figure 4 lists all the tasks that needed to be executed before the project was completed. Each category of the work breakdown structure table has three stages. Each stage of each category was completed before moving on to the next stage. For example, in the create category, the recruitment of 25-30 participants is dependent upon the creation of recruitment handouts. The project budget details the projected expenses needed to execute the project.

Figure 3

Gantt Chart

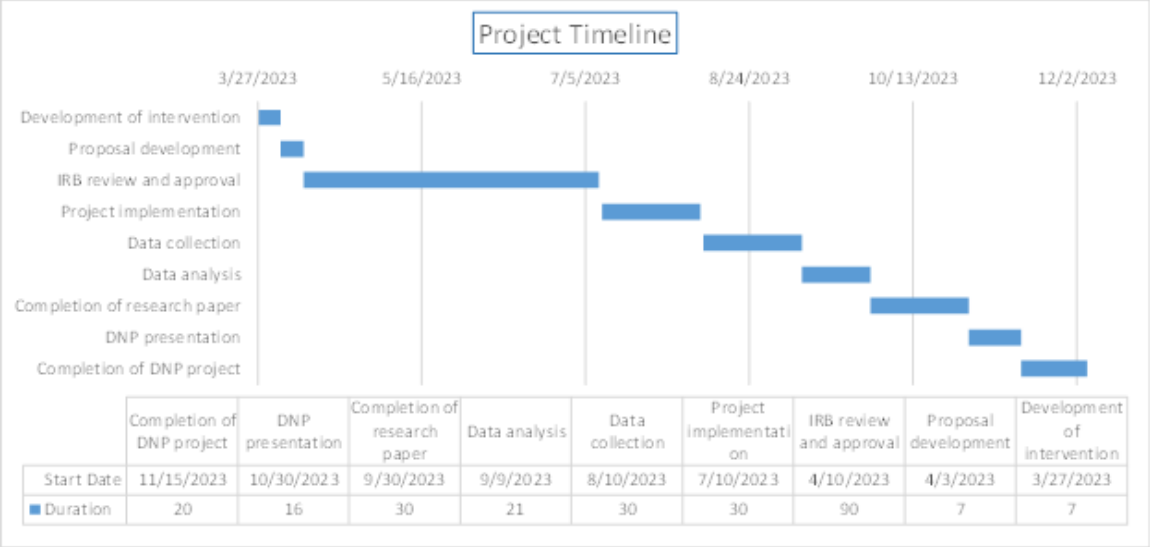


Figure 4

Work Breakdown Structure

Work Breakdown Structure

Stage	Create	Design	Plan	Analyze
1	Recruitment handouts	Pretest survey	Budget	Quantitative data
2	Recruit 25-30 participants	Education material	Time for patient education	Qualitative data
3	Obtain consent	Post-test survey	Time for post-education follow-up	Data analysis tool

Cost/Benefit Analysis

The project's cost included the cost of printing educational resources, estimated at around $50. The time spent on the educational intervention will be during patient appointment times so patients do not incur additional transportation costs. Any assistance

from staff was provided during current working hours so no additional costs were incurred for manpower.

This project was projected to be of great benefit to the patients by enhancing their knowledge regarding diabetic foot care, thereby improving their health and quality of life while reducing the risks of the physical, social, and emotional impacts associated with the problems related to diabetic foot ulcers. Patients would also benefit by removing the extra costs associated with diabetic foot ulcers. The practice could potentially benefit by showing health insurance companies that there is a need for additional education and care for diabetic patients, and additional time that is needed to make sure patients are properly educated, thereby minimizing additional costs to them (Elkashif et al., 2021). The state and private insurance carriers would benefit from not incurring the additional cost of treating diabetic ulcers in hospitals and outpatient settings.

Budget

Figure 5 depicts the project's budget.

Figure 5

Budget

Direct and Indirect Costs

Budget Item	Cost	Integrated into current facility expenses
	Direct Cost	
Recruitment flyer (5 copies)	$3.75	No
Pre-test survey (30 copies)	$5.70	No
Post-test survey (30 copies)	$5.70	No
Refreshments	$40	No
	Indirect Cost	
Computer use	$0	Yes
Office use for presentation	$0	Yes
Staff assistance	$0	Yes
Transportation	$50	No
Cleaning office room after use	$10	No
	Total Cost	
	$115.15	

Evaluation Planning

The logic model identifies the projects' intended goals and the effects of each program activity on the outcome. The logic model has two sides, the process, and the outcome. The process section addresses the project's inputs, activities, and output. The inputs are the resources that are required to implement the project (Zaccagnini & Pechacek, 2021). Activities are things like events, training, or education. The output is the immediate result of the project (Zaccagnini & Pechacek, 2021). The outcome section addresses the effect of the different processes which can be short-term or long-term in impact. The input, activities, and outputs all work together in sequence to reach our intended outcome.

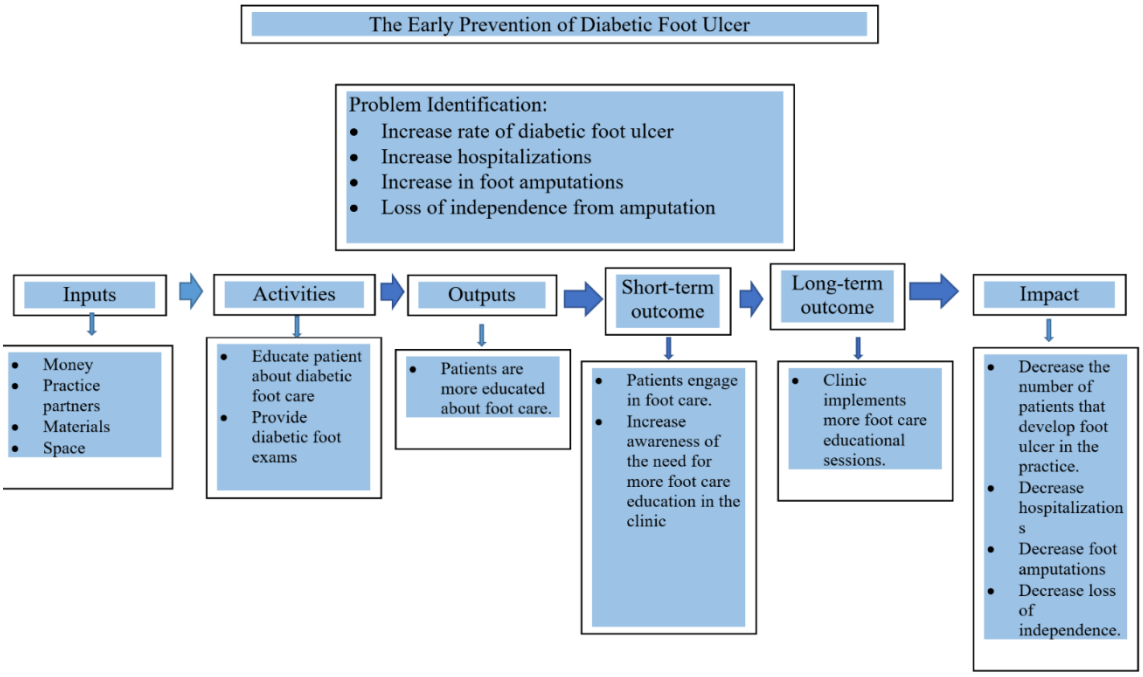
The goal of the project was to improve the knowledge level and increase the number of patients who engage in foot assessments in the facility. To accomplish this, an educational activity was created to meet this goal, and the list of materials and human resources needed to implement was assessed and gathered. To determine if the established outcome of increasing the number of patients who engage in and are more knowledgeable about foot care was successful, a pre- and post-survey was created. Participants completed a pre-survey before watching the educational video and a post-survey after the video. The results of the survey were then analyzed to determine if the outcome was met and the impact this project had on the facility. The project's closure was used to discuss findings and ways the facility can continue to make the desired impact on the patients for sustainability.

Logic Model

Figure 6 displays the early prevention of a diabetic foot ulcer logic model.

Figure 6

Logic Model



Implementation

QI Application Approval

Before the project was implemented, QI application approval from the university was necessary. This process consisted of creating a comprehensive layout of what the project was going to entail. This included presenting the consent forms, all surveys, and educational activities for the committee to review for appropriateness. QI application approval took 4 weeks to complete. Once the QI application was approved, the project site was notified and plans for project implementation began. The site did not require an additional approval.

Threats and Barriers

The project commenced after QI application approval was received from the university. The project site was aware of the details of the project and additional approval

through a facility Institutional Review Board was not required. The first part of the intervention was educating staff and providers with project information and providing supplemental education for refreshing knowledge on the topic. The front desk staff were educated on two separate days due to scheduling. Educating the providers required going to the office for the first week to meet with them due to scheduling to make sure that everyone is aware of the study and questions are answered. Having both pre- and post-surveys and the educational video electronically posed a challenge because it required a few extra steps from staff to make sure that patients understood what was required of them. The first threat to the project was not requiring patient participation. Not requiring patients to participate meant that staff could only offer education to them in hopes of participating. The second threat was the patient's anticipated wait time to see the provider was reduced due to the availability of Nurse Practitioner (NP) students at the site which made seeing the patients quicker than initially intended. The project started a week after its intended start date to allow for proper project implementation. The first week was spent performing a trial run to see how best to incorporate the project into the office's current flow.

Success

The staff were involved in bringing different ideas on how we could obtain increased patient participation. It was decided that the NP students would inform the front office staff when they have a diabetic patient who met the qualifications, and the project would be presented to them and asked for participation. By so doing, the patient went through the survey and watched the video prior to the provider seeing the patient. This

change required the DNP leader to be present at the office to obtain patient participation and to make sure the project was done correctly.

Monitoring of Implementation

The project implementation began once all staff were aware of the project's needs and goals. Because all project materials were provided electronically and it was a 3-step process, it was decided that access would be easier to have a tablet ready for the patients to use. Patients were identified once they presented for their visit. The front office staff would identify diabetic patients and then present the project information to the patient. If the patients were interested, the DNP project leader would prepare the tablet for patients while in the waiting room. Patients not captured during the pre-appointment wait time would be sought out once in the appointment room by the Medical Assistants (MAs) and Nurse Practitioner students. The MAs and NP students would identify diabetic patients and present the project information. The patients interested in doing the study were provided a tablet and handout with the QR code and project information. The patients would then answer the pre-survey questionnaire prior to watching an educational video. The educational video covered diabetic foot care and diabetic ulcer prevention. When they were finished, the NP student was informed and facilitated completing their visit with the medical provider. Once the visit was completed, the patient would be told to complete the post-survey. The goal was to have at least a minimum of 25 participants for the project. The office staff were all educated on the project and encouraged to participate to increase the chances of project success. The DNP project leader made frequent visits to the office to encourage participation and answer staff questions.

Project Closure

The project ran for 3 weeks, with a week break in between due to staffing shortages. We were unable to meet our goal of 25 participants as originally intended. Once the project was completed, the DNP project leader thanked the staff for their participation. The DNP project leader discussed a common theme among participants, which was the lack of knowledge about foot care and foot ulcers. The site manager discussed sustaining the educational efforts by providing the educational video to patients' pre-appointments to allow them enough time to watch it and come into their appointments with questions. Overall, they were pleased with the project focus and findings.

Data Interpretation

Quantitative Data

All project participants were presented with the pre-and post-survey. Twenty-four participants completed the pre-survey, and 20 participants completed the post-survey. All surveys were done anonymously which prevented correlation of the pre-survey and post-survey to one participant. The participants' responses were analyzed, and the data was categorized in terms of percentage. Stacked column charts were used for each question for optimal data visualization. The anonymity of the surveys posed a challenge in being able to track post-intervention responses in correlation to the pre-intervention participants, thus aggregate data was analyzed.

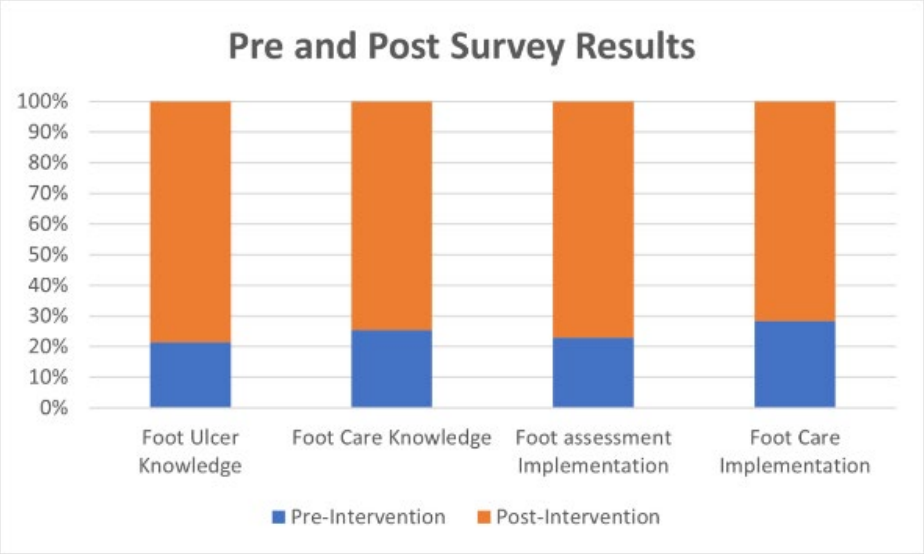
The chart below analyzes knowledge and implementation of pre-intervention and post-intervention. Pre-intervention, only 22.23% of participants had some knowledge of foot ulcer prevention. Post-intervention 81.25% of patients stated they were either

knowledgeable or very knowledgeable about foot ulcer prevention; an increase of 59.2%. Pre-intervention only 27.78% of people were knowledgeable about foot care. Post-intervention 81.25% of patients stated they were either knowledgeable or very knowledgeable; an increase of 53.47%. Pre-intervention only 22.22% stated they would implement foot assessments daily. Post-intervention 75% of participants stated they would implement foot assessments daily; an increase of 52.78%. Pre-intervention only 22.22% stated they would implement foot care daily. Post-intervention 56.25% of participants stated they would implement foot care daily; an increase of 34.03%.

Post-intervention patient knowledge and self-care agency improved drastically. The intervention surpassed the objective goal of improving patient knowledge by 40%. The goal of increasing the number of Type 2 diabetic patients that engage in foot assessment by 40% was also met by 52.78%. The intervention met 2/3 of the project objectives. The project gained participation from 24 participants with an intended goal of 25-30 (Figure 7).

Figure 7

Pre- and Post-Survey Results



Process Improvement Data

The interpretation of the data showed that over 70% of patients lack knowledge of diabetic foot care and ulcer prevention, and only 22 % of patients perform daily foot care and foot assessments. This data provided proof that patients in the practice need more education to prevent one of the main complications of diabetes which is foot ulcers. With the improvement in knowledge and self-care practice, the project proved the effectiveness of video teaching. The project did give us ideas on how to better serve the diabetic population at this practice. In the future, the NP students will be the main staff providing diabetic foot care education to patients. The office will also continue to make video education available for patients to watch in their free time. This project made an impact because it highlighted a need for more education, and created a new process that would increase staff participation, and decrease the burden on providers while meeting the needs of the patient.

Conclusion

Lack of knowledge has been identified as the contributing factor for why people with Type 2 diabetes do not practice foot self-care. Lack of time is one of the reasons why foot care education is not always provided to patients by their primary care provider. This research showed that most diabetic patients lack knowledge of foot care and ulcer prevention. The use of video teaching can be used pre- or post-appointment to bridge the education gap by 59.2% in this QI project implementation. Providing additional education also led to improved knowledge and plans for self-care behaviors, which should result in a reduction of foot complications. Finding ways to provide education in practice sites such as video teaching can possibly reduce the number of patients who are

unaware of foot care practices. Diabetes self-management education (DSME) has been shown to be the foundation for improving disease-related health outcomes. Educating patients on daily diabetic self-management strategies can help patients better manage their chronic illness and prevent major complications such as diabetic foot ulcers.

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Appendix A

DNP Recruitment Script

Our esteemed doctoral student is currently engaged in a project focused on diabetic foot care and ulcer prevention. We cordially invite you to participate in this project by kindly responding to a brief survey during your appointment. Your participation will greatly contribute to our efforts to enhance the quality of care provided to diabetic patients, ensuring they receive the necessary education and support for effective disease management.

Appendix B

Electronic Consent

Gardner-Webb University, Hunt School of Nursing, QI Committee
Informed Consent Form for Online Survey
The early prevention of a diabetic foot ulcer

The purpose of this Quality Improvement (QI) project is to improve the process of educating diabetic patients on diabetic foot care and ulcer prevention while increasing the number of patients that are knowledgeable about diabetic foot care in the practice.

As a participant in the project, you will be asked to fill out a presurvey questionnaire, watch a video on diabetic foot ulcer prevention, complete you scheduled routine appointment your health care provider and fill out a post-survey. If there are any questions on the survey you feel uncomfortable answering you can skip the question.

It is anticipated that the project will require an extra 25 minute of your time outside of your regular scheduled appointment time. Participation in this project is voluntary. You have the right to withdraw from the QI project at any time without penalty. You also have the right to refuse to answer any question(s) for any reason without penalty. The information that you give in the project will be handled confidentially. Your data will be anonymous which means that your name will not be collected or linked to the data. There are no more than minimal anticipated risks in this project. You will receive no payment for participating in the project. You have the right to withdraw from the project at any time without penalty by exiting the survey, simply by closing the browser window. Data from this project will not be used or distributed for future research studies.

Appendix C

Patient Education Video Link

Link to watch: https://www.youtube.com/watch?v=ra4NW_mvyeI